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# Worldwide Report

NUCLEAR DEVELOPMENT AND PROLIFERATION

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25 June 1984

# WORLDWIDE REPORT

## NUCLEAR DEVELOPMENT AND PROLIFERATION

### CONTENTS

#### EAST EUROPE

##### CZECHOSLOVAKIA

- Nuclear Project 'SPIN' Outlined  
(Michal Strida; RUDE PRAVO, 28 Apr 84) ..... 1

#### LATIN AMERICA

##### BRAZIL

- Briefs  
Pump Problem at Angra ..... 5  
Euro Bank Loan for Nuclebras ..... 5

#### NEAR EAST/SOUTH ASIA

##### INDIA

- India Trying To Retain Seat on IAEA Board  
(G. K. Reddy; THE HINDU, 1 May 84) ..... 6
- Expert Says India May Be Compelled To Build N-Arsenal  
(PATRIOT, 29 Apr 84) ..... 8
- Official Explains Working of Tarapur Disposal Plant  
(PATRIOT, 2 May 84) ..... 9
- Minister Notes Steps To Meet Pakistan Nuclear Threat  
(PATRIOT, 9 May 84) ..... 11
- Briefs  
Enriched Uranium Arrives ..... 13  
U.S. Data 'Leak' ..... 13

## IRAN

- Atomic Energy Chief Elaborates on Country's Nuclear Project  
(JOMHURI-YE ESLAMI, 5 May 84) ..... 14

## ISRAEL

- Advantages of Nuclear Over Coal Energy Said Not Significant  
(Charles Hoffman; THE JERUSALEM POST, 17 May 84) ..... 16
- Burial of Nuclear Waste in Negev Considered  
(Ya'acov Friedler; THE JERUSALEM POST, 17 May 84) ..... 17

## PAKISTAN

- India, Pakistan's Nuclear Options Discussed  
(M. B. Naqvi; VIEWPOINT, 17 May 84) ..... 19

## SYRIA

- Briefs  
Nuclear Reactor Reportedly Built ..... 23

## SUB-SAHARAN AFRICA

### NAMIBIA

- SWAPO Threatens To Sue UK Over Uranium Supplies  
(SAPA, 11 Jun 84) ..... 24

### NIGERIA

- Minister on Uranium Production, Tin Rationalization  
(NAN, 7 Jun 84) ..... 25

### SOUTH AFRICA

- U.S. Anti-Nuclear Campaign Cripples Beisa  
(Don Robertson; SUNDAY TIMES-BUSINESS TIMES, 6 May 84) ..... 26
- Controversy Over Koeberg Power Station Examined  
(Chloe Rolfes; SUNDAY TIMES MAGAZINE, 13 May 84) ..... 28
- Official Sees No New Nuclear Power Stations Soon  
(Priscilla White; RAND DAILY MAIL, 24 May 84) ..... 33
- Effects of Nuclear Attack on Johannesburg Projected  
(Michael Stent; RAND DAILY MAIL, 12 May 84) ..... 35

TANZANIA

Commentary on 6-Nation Plea To Halt Nuclear Tests, Deployment (Editorial; DAILY NEWS, 24 May 84) .....	39
---	----

WEST EUROPE

PORTUGAL

Briefs Nisa Uranium Industrial Complex	40
---	----

SWITZERLAND

Problems With Disposal of Radioactive Waste (NEUE ZUERCHER ZEITUNG, 2 Jun 84) .....	41
--	----

TURKEY

International Flurry Over Akkuyu Nuclear Project (CUMHURIYET, 24 Apr 84) .....	43
---	----

## NUCLEAR PROJECT 'SPIN' OUTLINED

Prague RUDE PRAVO in Czech 28 Apr 84 p 4

[Article by Michal Strida: "The SPIN Program"]

[Text] They began where Academician Pjotr Kapica had left off 50 years previously, in the area of very low temperatures and strong magnetic fields. In the course of a half century, however, only technology has improved, even though there are only a few laboratories in the world where it is possible to achieve temperatures on the order of 10 millikelvin, or -273 degrees Celsius--practically absolute zero--under the simultaneous action of a strong magnetic field, and to place into this extreme environment radioactive nuclei obtained from a proton accelerator, a synchrocyclotron.

There was no way to create such extreme conditions in any of the Czechoslovak physics laboratories. In addition, the construction of the cryogenic equipment needed to produce very low temperatures not only represented a complex technological problem but was also unusually expensive. The only laboratory in the socialist countries, and, at the period when the SPIN project was designed, the only one in the world where these physically extremely demanding conditions could be satisfied, was the Joint Institute for Nuclear Research in Dubna near Moscow. The design of the SPIN program, worked out in 1973, was approved early in 1974 by the scientific director of the institute.

### Two Birds With One Stone

The physics of very low temperatures combined with strong magnetic fields makes it possible to study ordered sets of atomic nuclei. It thus proves possible, figuratively speaking, to kill two birds with one stone. At very low temperatures approaching absolute zero, one could, according to the concepts of classical physics, arrest the thermal oscillation of atoms, as it were freezing them into a lattice. The fact that this never actually occurs can be attributed to their angular momentum, or spin, which is different for every atomic nucleus. This is a basic value characterizing each specific type of nucleus and taking the form of a vector.

Under normal circumstances the spins of sets of atomic nuclei are unordered (chaotic). To orient the atomic nuclei means spatially to order the spins of the nuclei. This is accomplished through the use of very low temperatures and very strong external magnetic fields. The use of oriented sets of atomic nuclei is thus a method for observing one single nucleus. If we observe unordered sets of atomic nuclei, the resultant picture is the same as it would be if we were to observe a single nucleus having identical properties in all directions.

If we encounter spins oriented in all directions like the spins of a hedgehog which has rolled itself up into a ball, we have no way of knowing just where the head or feet are. If, on the other hand, we order the spins, the nuclei will appear differently depending on the angle of observation.

We can, of course, only observe the nuclei either by using projectiles (which are particles with which we bombard the nuclei), or else by studying the radiation (gamma or beta) emitted directly by the unstable nuclei under observation. Angular analysis of the radiation emitted in turn affords us information both on the atomic nuclei studied and the emitted radiation.

If the nucleus is interacting in some way with the environment, information can also be obtained on the environment, and this can be used, for example, in the physics of solid bodies to determine their magnetic properties. The data obtained from sets of oriented nuclei either cannot be obtained in any other way or else the methods used are simpler and less ambiguous than other, more complex, methods already known to physics.

One of the fundamental problems of experimental nuclear physics in the area of research on the structure of the atomic nucleus is the study of the properties of nuclei far outside the so-called region of stability with respect to beta decay. These are predominantly short-lived radioactive nuclei which do not arise in nature and which can be obtained in accelerators or in reactors.

#### We Joined Forces

"I have been working with proton polarized targets since 1965, to be sure in the area of high energy physics," recalls Eng. Zdenek Janout, CSc, assistant professor at the Faculty of Nuclear Engineering and Physics of the Czech Institute of Technology. "When Eng Miroslav Finger, DrSc, of the Faculty of Mathematics and Physics of Charles University approached me in 1972 with a proposal for the SPIN project, we went to see RNDr Stanislav Sfarata, CSc, of the Department of Low Temperatures in Reza to find out if this project could actually be realized. He thought us rather idealistic, but finally said that it would be possible, but only in Dubna near Moscow. Fortunately, all of us here had worked there for many years in the past, had experience with the experimental facilities, and were familiar with the level of available technology."

In Dubna the entire program was also discussed with Boris Neganov, Doctor of Physical Sciences, who had constructed unique refrigeration equipment used to obtain extremely low temperatures. His experience was also later used in constructing the SPIN 1 and SPIN 2 experimental apparatus in the Laboratory of Nuclear Programs, apparatus designed for studying the decay of oriented radioactive nuclei over a broad range of atomic and mass numbers and having a half-time of decay of over 1 hour.

The time required to separate radioactive isotopes after bombardment in an accelerator, the technological preparation of the sample, and its placement into the SPIN experimental apparatus, where the sample is cooled to the required temperature of about 10 millikelvins under the simultaneous action of a strong magnetic field (on the order of tens of tesla), places limitations on the possible half-time of decay of the nuclei studied. Nuclei with a shorter half-life would decay before measurements could be started.

The cryogenic portion of the apparatus, which makes possible the rapid exchange of samples without breaking the vacuum, is by its parameters one of the best in the world. Gamma radiation produced by the decay of the oriented radioactive nuclei is recorded by semiconductor devices and the resulting data are processed on an SM 3 computer.

#### Transition Zone

Basic research has been concentrated on atomic nuclei in the so-called transition zone, i.e., the zone which includes both strongly deformed and spherical nuclei, meaning the rare earth elements having a mass of about 150, in particular, isotopes of terbium, gadolinium, dysprosium, etc. Through the comparison of nuclei which differ only slightly in the number of neutrons but are nevertheless different in form, scientists can gain a better understanding of the general laws of their construction.

Four international conferences have already been held on the SPIN project and a fifth is in preparation. This in itself gives some idea of its significance, as does the fact that preparations are under way for the installation of experimental SPIN equipment in Czechoslovakia, in laboratories in Prague, at Pelc-Tyrolec, of the Department of Low Temperatures of the Faculty of Mathematics and Physics of Charles University. In 1979 the SPIN program was granted the status of an institute by the Science Council of the Joint Institute for Nuclear Research.

#### Broad Application

Realization of the SPIN experiment has been possible thanks only to multilateral collaboration between the Czechoslovak and Soviet physics bases and specialists in the area of cryoengineering. In addition to outstanding results achieved in the area of theoretical understanding, the development of the SPIN apparatus has also been of practical significance, since in many areas it was necessary to go beyond the current



limits of technological capabilities, for example, of the materials used in the various cryogenic devices. This is favorably reflected in other cryogenic equipment, which already has practical significance. The SPIN equipment was also constructed using certain new computational methods and complex electronics, which have not yet found direct application in other areas of technology. Also promising are certain possibilities for direct application in studying the properties of materials used in the electrical engineering industry and in electronics.

The SPIN program has also become a good school for some of our university students, who have participated directly in solving partial tasks. Over the past 10 years, 10 students of the Faculty of Nuclear Engineering and Physics of the Czech Institute of Technology and 6 students of the Faculty of Mathematics and Physics of Charles University have written their senior theses within the framework of this program.

The theoretical creators of the SPIN program, Miroslav Finger, DrSc, of the Faculty of Mathematics and Physics of Charles University, Zdenek Janout, CSc, of the Faculty of Nuclear Engineering and Physics of the Czech Institute of Technology, and Stanislav Safrata, CSc, director of the Laboratory of Low Temperatures of the Physics Institute of the Czechoslovak Academy of Sciences, have been awarded the Kliment Gottwald State Award for their work.

The SPIN project is a part of our state plan for basic research and will be continued during the next 5-year period.

9832

CSO: 5100/3017

## BRIEFS

PUMP PROBLEM AT ANGRA--The Furnas Electric Power Plants, Inc. yesterday informed that the Angra I nuclear power plant, which was operating on an experimental basis, again became paralyzed last Monday due a problem in one of the two water-carrying pumps of the chemical and volumetric control system. The stoppage will last for 20 days. The problem appeared during tests that were being made in the control system. The pump vibrated and unusual noises were heard. Although the affected equipment has no relation to the security of the reactor or even the plant, the operative technical rules demand that at least two pumps be in condition to operate the auxiliary system. Furnas technicians are making arrangements for the substitution of the pump and studying the causes of the problem. [Text] [PY041836 Rio de Janeiro JORNAL DO BRASIL in Portuguese 2 Jun 84 p 16]

EURO BANK LOAN FOR NUCLEBRAS--Nuclebras President (Dario Gomes) signed an \$80 million loan contract with a consortium of banks headed by the European-Brazilian Bank in London today. This loan, and the \$90 million one for which a contract will be signed with a consortium of FRG banks headed by the Commerce Bank in Frankfurt next week, will be used to finance this Brazilian nuclear program in 1984. [Text] [Brasília Domestic Service in Portuguese 2200 GMT 25 May 84 PY]

CSO: 5100/2108

## INDIA TRYING TO RETAIN SEAT ON IAEA BOARD

Madras THE HINDU in English 1 May 84 p 9

[Article by G. K. Reddy]

[Text] NEW DELHI, April 30--Diplomatic efforts are being made behind the scenes to resolve the question of India's continued representation as one of the permanent members of the board of Governors of the International Atomic Energy Agency following China's admission to it.

At one stage the big powers were trying to quietly down-grade India from the status of a "globally advanced" country to a "regionally advanced" one to make way for China's inclusion, without increasing the total number from the present figure of 12 on the 34 member board.

But after India's strong protests, followed by threats that it might even leave the IAEA, they are now considering two alternatives which would involve an amendment of the relevant statutes of the organisation. One suggestion is that the number of "globally advanced" members should be increased from nine to 10, and the other is to expand the total strength of the two designated categories from 12 to 13, without specifying what status China and India would have in such a situation.

Best solution: The Indian view is that the best solution to this tangle would be increase the number of globally advanced from nine to 10, so that both India and China could be accommodated as permanent members of the board. But if the intention is to increase the total number of both categories, globally and regionally advanced members from 12 to 13, then this distinction should be abolished to give equal status to all of them.

Serious situation: The big powers are reported to be veering round to the view that, unless the board decides to recommend to the general council of the 112 member body to opt for one or the other of these two courses open to it, the Agency is going to be faced with a serious situation. If India were to quit in protest in the absence of an acceptable solution to this problem it would be well within its right to insist on renegotiation of the IAEA's inspection rights and responsibilities in fulfilment of its safeguards obligations in the changed context.

The present nine globally advanced permanent members are the U.S., Canada, Britain, France, West Germany, Soviet Union, India and Japan with Italy and Belgium sharing one seat. The three regionally advanced are Argentina and Brazil sharing one seat, Australia and Egypt. If China were to be included in the globally advanced category and India is retained as a permanent member without defining its status, with the excuse that the cumbersome process of amending the statutes to increase the number of nine to 10 will take a long time, it would be placed in the invidious position of being treated as only a regionally advanced one for all practical purposes.

This virtual down-gradation of India's status, under the guise of accommodating China, would allow a country like Pakistan to stake its claim at some stage for representation on a rotational basis by questioning India's right to a permanent place. It is to pre-empt such a move that India is insisting that its position as a globally advanced country should be safeguarded by increasing the number of this category from nine to 10 or by abolishing the distinction between the two types of members.

Not opposed to China: The point that India has been stressing in its diplomatic exchanges with the big powers is that it is not opposed to China being given a permanent seat as one belonging to the first category, but this should not be done at its expense by indirectly down-grading its position. The Indian stand right through has been that China should be brought into the IAEA, so that it could be prevailed upon to adhere to the obligation not to transfer nuclear technology to third countries without proper authorisation.

CSO: 5150/0011

EXPERT SAYS INDIA MAY BE COMPELLED TO BUILD N-ARSENAL

New Delhi PATRIOT in English 29 Apr 84 p 5

[Text] In a global and regional environment which is getting increasingly nuclearised, India may have no alternative to building a modest nuclear arsenal, says defence expert Col R Rama Rao in a new book--'Self-reliance and Security', reports PTI.

There are disquieting reports suggesting that a neighbouring country has already started stockpiling nuclear weapons or is close to doing so, the book says. Further, the adjoining ocean is also being militarised and saturated with nuclear bases and arsenals.

India, Col. Rama Rao points out, has chosen to adhere to its policy of utilising nuclear technology for peaceful purpose and yet the country will need to defend itself against possible future nuclear threats.

The author has called upon the Defence Ministry and the armed forces to study the subject of nuclear defence and also defence against chemical warfare since potentially hostile forces possess these munitions.

At the global level, the super powers are engaged in a major nuclear arms race and its spillover has intensified nuclear arms build up of the lesser powers like UK and France.

In this environment of increased nuclearisation of the world, says the book brought out by the Birla Institute of Scientific Research, India may well be forced to embark on a programme to build a modest nuclear arsenal.

Hopefully, it says, India's plea for reduction and eventual elimination of nuclear weapons, would then be heard more seriously in super power capitals.

CSO: 5150/0009

# OFFICIAL EXPLAINS WORKING OF TARAPUR DISPOSAL PLANT

New Delhi PATRIOT in English 2 May 84 p 5

[Text] Bombay, May 1 (PTI)--The country's nuclear power programme has taken a giant leap in ensuring total safety to the environment with the setting up of the first nuclear waste disposal plant at the Tarapur atomic power complex.

The director of the Bhabha Atomic Research Centre (BARC) here, Dr P K Iyengar said that the entire plant known as 'the nuclear waste immobilisation plant' had been developed indigenously.

'A second such plant would be set up in the BARC by the year end', he said.

With the setting up of the plant India has joined a select band of countries like the UK and France, who use the same technology to dispose of the highly radioactive nuclear waste.

Nuclear waste from atomic reactors needs to be handled cautiously as any lapse could result in serious contamination of the environment and pose health hazards to people exposed to it, Dr Iyengar pointed out.

Explaining the basic principle of the plant, Dr Iyengar said that nuclear waste can be divided into two types--one with low radioactivity and the other with very high activity.

Low activity waste consists of isotopes which emit radiations only for a limited period and can be stored in cement containers without any danger to the environment. Such isotopes are the ones used in medicine and radiation treatment, he said.

But elements like strontium which constitute high activity waste continues to emit lethal radiations for thousands of years. In the early period of about 30 to 50 years this waste generates tremendous amount of heat and should be stored at a controlled temperature, he said.

The high activity waste, Dr Iyengar said, is first moulded with glass by heating to temperatures up to 1,000 degrees centigrades, and then cooling it down. Glass capsules containing the waste are further enclosed in a stainless encasement, which is kept in the plant under certain controlled conditions. When

the temperature comes down after 30 to 40 years the waste encasement will be dumped into deep abandoned mines.

Asked why glass is chosen to store the waste, he said, glass is the material that it does not get washed out or corroded for many years.

CSO: 5150/0012

MINISTER NOTES STEPS TO MEET PAKISTAN NUCLEAR THREAT

New Delhi PATRIOT in English 9 May 84 p 1

[Text] India has taken adequate measures to counter any "misadventure" of a nuclear attack by Pakistan, Defence Minister R Venkataraman assured the Rajya Sabha on Tuesday.

Mr Venkataraman, refuting the suggestion that Pakistan is 20 years ahead of India in the nuclear field, said "to the best of my knowledge we have a nuclear technology which is abreast..."

He, however, refused to furnish details on the issue as the strategy could not be disclosed in the House in the best interests of the security of the country.

Replying to the calling attention motion the Defence Minister said India had no definite information whether Pakistan had acquired nuclear capability, but he cited Pakistan's atomic energy chief who was reported to have claimed that they had achieved it. "We have to proceed on the assumption that Pakistan has the capability", he added.

The motion, which stood in the name of BJP member Jaswant Singh and 13 others, pertained "to the threat posed to India's security on account of developments along Indo-Pak borders and Pakistan's nuclear programmes".

He reiterated that India had no intention of joining the nuclear club to further escalate the nuclear arms race in the face of a demand from Congress-I member R N Yadav that India should manufacture nuclear arms to face the threat from Pakistan.

"It would be ridiculous for a country to think of manufacturing nuclear bombs, while it has been advocating complete ban on nuclear armaments at all world forums", he remarked.

While Pakistan was claiming that the sophisticated arms that it was procuring from the US and the other Western countries were meant for Afghanistan, he said two divisions had deployed along the Afghanistan border and one in Baluchistan.



Could Pakistan use Harpoon missiles against Afghanistan? he wondered.

All this information, he said, he had given to the House to show the Indian Government was not exaggerating the threat to the country's security, as was suggested by some members earlier.

Earlier, the members by and large expressed concern over the induction of large scale arms into Pakistan and generally supported the Indian Government's policy towards its neighbours.

BJP member Jaswant Singh, who initiated the debate on the calling attention motion wanted to know that if the Government was going to take up issue of arms race, recent reports of border and space violations by Pakistan in the forthcoming meeting of the foreign ministers of the countries.

CPI-M's K Mohanan too supported Mr Bhatia's contention but said Pakistan at this juncture was keen for a confrontation with India to divert the attention of its masses who were struggling for their independence.

CPI member Chaturanan Mishra supported the Government's policy but wanted to know the steps being taken to counter the threat.

Janata member M S Gurupadaswamy wanted to know if the Government had made any study on the issue of Pakistan's arms race over India.

CSO: 5150/0014

## BRIEFS

ENRICHED URANIUM ARRIVES--HYDERABAD, April 26--About 21 tonnes of enriched uranium, enough to fuel the Tarapur atomic power plant till this year-end, has arrived at the Nuclear Fuel Complex (NFC) here, Dr. N. Kondala Rao, NFC chief executive, said here today. The final instalment of the first consignment of the fuel was delivered to the complex a few days ago. France had agreed to provide the enriched uranium after the U.S. had backed out of its obligation. The plant was built under an Indo-U.S. agreement and the U.S. was to supply enriched uranium throughout the plant's life. The fuel would be processed into rods here and then shipped to Tarapur. [Text] [Madras THE HINDU in English 27 Apr 84 p 1]

U.S. DATA 'LEAK'--NEW DELHI, April 27 (UNI)--The United States has given to Pakistan the entire plan and specific location of India's atomic energy establishment at Trombay. The minister of state for external affairs, Mr. A. A. Rahim told the Rajya Sabha today that the government had seen reports to this effect and had taken up the matter with the United States government. However, Washington has denied the veracity of such reports, he added. Replying to another question, Mr. Rahim said the government was also aware of reports about China's secret link with Pakistan and supply of critical nuclear assistance and designing of atomic weapons. The government, has taken note of statements by some responsible American government officials in this regard, he said. [Text] [Bombay THE TIMES OF INDIA in English 28 Apr 84 p 1]

CSO: 5150/007

## ATOMIC ENERGY CHIEF ELABORATES ON COUNTRY'S NUCLEAR PROJECT

Tehran JOMHURI-YE ESLAMI in Persian 5 May 84 p 9

[Text] So far 20 billion tumans have been invested in the Bushehr nuclear reactor, and more than 80 percent of Unit One of that reactor has been completed. In a press and radio-television interview last Thursday morning, Eng. Reza Amrellahi, chief of the Iran Atomic Energy Organization, announced the facts above, denied rumors by western and eastern media about Iran obtaining an atomic bomb during the next two years, and described the plans to utilize the nuclear industry in Iran. At the beginning he said: Last week we witnessed a wave of propaganda, which originated from Arab media, was picked up by a British newspaper (JANES DEFENCE), and finally was made use of by most of the arrogant western media which relied on that newspaper's article. The aforementioned newspaper claimed that Iran would obtain an atomic bomb within the next two years, and finally this topic was cunningly linked to the Bushehr nuclear reactor. On this subject he added: It will take another five years at least before it will be operational. Therefore all persons involved in this industry immediately realized the baselessness of this implication in light of this period of time. They understand that this claim of using it to build an atomic bomb within the next two years is nothing more than a rumor. In addition, this reactor will be completed and prepared for operation solely for the production of electric power.

He then pointed to the reasons that the Iran Atomic Energy Organization denied the news given by the British newspaper and other western and eastern media, and said: The Iran Atomic Energy Organization has been a member of the International Atomic Energy Agency, and respects its regulations, particularly the regulations on preventing the spread of nuclear weapons.

Secondly, it respects the signature on articles P and T of it concerning preventing the spread of nuclear weaponry. In addition, just as we announced last year in the twenty-seventh annual meeting of the International Atomic Energy Agency, we are ready to become a member of a policing organization that would be administered by the non-aligned countries of the Third World. This organization would inspect all the arsenals of the large nations and report on them to the world's people. Therefore, in light of these statements, it is clear which persons are raising a ruckus and which persons are daily plotting to wither the roots of knowledge in the world's oppressed countries.

He then pointed to the plans to utilize nuclear industries in Iran. He described their goals as the discovery, extraction and production of uranium yellow-cake in Iran, the use of nuclear energy in the industries to prepare and produce radio-isotopes for agriculture and industry, servicing of all the organizations involved with radiation, strengthening protection against radiation throughout the country, etc..

9597

CSO: 5100/4720

## ADVANTAGES OF NUCLEAR OVER COAL ENERGY SAID NOT SIGNIFICANT

Jerusalem THE JERUSALEM POST in English 17 May 84 p 3

[Article by Charles Hoffman]

[Text]

The energy planner whose work led the Horev Committee to recommend switching to nuclear power has now challenged his own conclusions. In a paper presented yesterday, Dr. Yona Bargur said that the economic benefits of nuclear power compared to coal were not that significant, and the entire matter should be re-examined.

Bargur, who is the director of the centre for energy and economics at Tahal Consulting Engineers, Ltd., spoke at a session of the conference on Energy in Small and Medium-Sized Countries held in Tel Aviv. Bargur headed the team of economists who prepared the cost-benefit analysis of nuclear power for the Horev Committee, which submitted its recommendations.

Bargur said that the system used to calculate the comparative economic benefits of coal and nuclear power for the Horev Committee produced results that were "incon-

clusive," leading decision-makers to rely heavily on their preferences in making the decision to go nuclear.

He said that this system - which projects the effects of different possible interest rates, rates of increase in the price of coal and the investment costs of nuclear reactors on expected benefits - presents decision-makers with 27 separate scenarios without determining which of them is the most probable.

The set of projections adopted by the Horev Committee indicated a benefit of \$1.1 billion for the economy over 20 years if power plants built during that time were nuclear instead of coal-fired.

Bargur presented a new procedure yesterday for weighing the probabilities of various investment scenarios. His results showed that the most probable scenario produced a benefit of \$700 million instead of \$1.1b. "With an investment of \$15b.-\$16b. in nuclear power stations over 20 years, \$1.1b. is a

reasonable return, but less than that would be problematic," he said.

Moreover, Bargur said, his calculations showed that there was a 40 per cent chance that the benefits of nuclear power over coal would be zero or minus. "That is a big risk considering that nuclear power poses more complicated environmental and construction problems than coal."

Bargur did not change his previous conclusion that nuclear power would be cheaper than coal if the two were compared on a cost-per-kilowatt-hour basis. A nuclear-power plant of 1,100 megawatt capacity is estimated to cost \$2b. to build, whereas a coal-fired plant of the same capacity would cost half that sum.

Bargur recently submitted his revised conclusions on the benefits of nuclear power to the Energy and Infrastructure Ministry and to Amos Horev, who headed the committee that examined the issue, but has received no response.

CSO: 5100/4504

## BURIAL OF NUCLEAR WASTE IN NEGEV CONSIDERED

Jerusalem THE JERUSALEM POST in English 17 May 84 p 3

[Article by Ya'acov Friedler]

[Text]

HAIFA. - Israel could earn a billion dollars a year by burying in the Negev the nuclear waste from America's atomic power plants, according to Professor Bernard Cohen, an expert on energy and environment from the University of Pittsburgh Physics Department.

"The only high technology needed is to overcome the public insanity regarding the risks, which are infinitesimal," Cohen told *The Jerusalem Post* during an interview at Haifa's Technion, where he is spending two weeks.

Cohen said nuclear-waste-disposal profits would be as high as 90 per cent. The waste to be disposed of totals 15 tons a year, taking up a compact five cubic metres.

"The only hazard would be from contact with groundwater" and would lead to 1.5 deaths from cancer in a million years "if no cancer cure is found by then," he said.

Cohen said he had been told that there were places in the Negev where nuclear waste could be buried 1,000 metres deep, far from any groundwater. He said he could foresee European countries burying their waste here and giving Israel additional income. The "irrational fear," he said, was so deep-rooted that they would be happy to dump the waste in places other than their own countries.

Cohen, who has analyzed nuclear-

power-plant waste, said risk probability is 0.1 deaths from cancer from one plant per year, or 1 death in 100 years.

On the other hand the waste from coal-burning power plants involves the risk of 25 deaths per year from air pollution alone, and another 70 from carcinogens that the coal burning produces, such as arsenic, beryllium and cadmium, which Cohen said last forever. Moreover, the uranium in coal releases radon gas, which could cause another 30 deaths a year, according to Cohen.

"Coal burning is 10,000 times worse than atomic energy regarding the number of people it will kill," he asserted.

Cohen said he could only counsel Israel to cash in on nuclear-waste disposal and also to go ahead with its own nuclear power as quickly as possible.

He said he considered nuclear-power stations extremely safe with regard to possible accidents. Even if bombed, they would not explode; the worst that could happen would be a meltdown of the uranium core, Cohen said.

The probability of a meltdown has been calculated by the U.S. government at one in 20,000 reactor years, or one in 200 years for 100 reactors.

The anti-nuclear lobby contends that the risk is to be ten times higher, one in 2,000 reactor years.

But even if a meltdown occurred, there would be no large release of

radioactivity, Cohen asserted. He calculated that the risk of death from radiation sickness in the U.S. would be two cases in one per cent of the meltdowns, while cancer risks would, in the worst case, rise from the present 20 per cent average to 20.5 per cent. He noted that the average now fluctuates at between 15 and 23 per cent in various states "and nobody even knows the differ-

ence".

His analysis showed that the Loss of Life Expectancy (LLE) from nuclear power in the U.S. is 0.03 years, compared to four to five years from poverty, 1,600 days from smoking one pack of cigarettes a day, 900 days from being 30 pounds overweight, and 40 days from the speed limits being raised from 90 to 105 kilometres per hour.

CSO: 5100/4504

## INDIA, PAKISTAN'S NUCLEAR OPTIONS DISCUSSED

Lahore VIEWPOINT in English 17 May 84 pp 18-19

[Article by M. B. Naqvi: "Pakistan's Nuclear Options"]

[Text]

WHAT Dr. A.Q. Khan told 'Nawa-i-Waqt' in February 1984 was later confirmed by the Pakistan CMLA-President. It constitutes a formal declaration by Pakistan of having attained the (nuclear) status of being able to manufacture weapons-grade enriched uranium. It is also tantamount to the near-capability of being able to produce a few atomic bombs or devices. Further qualifications about not intending to, or being engaged in, making nuclear weapons or devices of any kind have been made. Some people may accept them at face value and certain others will not.

There is some questioning about the precise reason why the Pakistan Government has chosen to make this declaration and whether its timing is significant. No information on these subjects is available. But several conclusions can safely be drawn.

First, such declarations are not made without adequate calculations about their consequences. Secondly, either it was more important to convey some specific message to the Powers that are closely interested in the subject; or holding back the information might not have remained, in Islamabad's view, possible. Thirdly, it might be a part of a larger diplomatic design; to wit, forcing India to negotiate seriously and sign a no-war pact.

## The background

The background to the subject is well known. Many foreign Powers

had been accusing Pakistan of surreptitiously trying to acquire nuclear capability with a view to making atomic weapons, the so-called Islamic Bomb. Almost all major Powers had frowned upon this attempt. The United States, in particular, has been leading the pack; almost all information on the subject, on closer scrutiny, has turned out to have emanated from just one source - the American CIA.

The US, it may be recalled, had cut off all military and economic aid to Pakistan in April 1979. Earlier it had forced the French authorities to go back on their contractual obligation to provide Pakistan with a nuclear-fuel-reprocessing plant. Despite recent improvements in the Pakistan-American relations, there are reasons to believe that the basic American stance on the nuclear issue has not changed. The Reagan Administration has merely changed the style of pressing its viewpoint.

The American Ambassador to Pakistan was talking, some time back, of certain vulnerabilities in his country's relationship with Pakistan. One of these was the difference of opinion over the nuclear question. Therefore, it stands to reason that the Pakistan Government must have taken into account the likely reaction of disapproval in Washington. The question now is about the American reaction. Whether it would now be of resigned acceptance of a fait accompli or whether opposition in some form



would continue?

It is also understandable that other members of the so-called London Club would also disapprove. While many of these, except the US and now the Soviet Union, have little leverage over Pakistan, it is nevertheless important for Pakistanis to be sure of their reaction. If all of them were strongly to disapprove and thought likely to follow it up with whatever action that may be possible for them, it would be no light matter. Insofar as super-Powers are concerned, if they were to disapprove but decide to accept the fait accompli, life would be easy. But not so if their disapproval leads to a frame of mind in which some action is contemplated. That would be a grave matter.

Among the other foreign Powers, a unique position is occupied by India. While it is not a London Club member, it acquired what was called the nuclear franchise as far back as 1974 when it detonated its so-called peaceful nuclear device. Relations between India and Pakistan are, of course, an example of how beastly two neighbours can be towards each other. Their relationship is characterised by deep mistrust of each other's intentions and much ill-will. As it happens, they are engaged in an intense arms race and there is much talk of war. The question is what signals will India read in this confirmation of previous suspicions?

Important non-official Indians and some officials informally have said in the past that Pakistan is entitled to acquire nuclear know-how and even weaponry if it wants to, just as much as India is.

#### Ominous words

But that is not the position of the Indian Government. Nor should we misunderstand the foregoing kind of remark. The news of Dr. A.Q. Khan's interview had an electrifying effect in New Delhi. Their Defence and Foreign Ministers took pointed notice of it and cryptically said that India will have to take appropriate measures in the light of this major development. These are, to put it mildly, ominous words.

While the disapproval and even consequential action by distant foreign

Powers can be hurtful to us in Pakistan, this bears no relationship to the instant exacerbation of the arms race between India and Pakistan and its likely extension into the nuclear sphere. We, the Pakistanis, should face this fact in all its dimensions. If we keep the logic of the present India-Pakistan relationship, arms race and the rest, in sharp focus, the major Indian follow-up action would be to pull away the stops and go nuclear all the way.

For no Indian policy-maker would believe that, having acquired the capability, Pakistan would actually not make as many nuclear bombs as it can. Firstly, no Pakistani strategist can prognosticate that the Indians will react otherwise. Secondly, his own actions will be governed by this assessment of the likely Indian course of action. This means a full-fledged arms race in the nuclear field between the two bigger local Powers in the sub-continent. This is the relentless logic of *realpolitik*, however regrettable it may be; and we shall be living in a fool's paradise if we fail to see this consequence.

This is supported by history. When India made its Pokhran detonation in May 1974 and said it will not make the Bomb, what did Pakistan do? It vowed to eat grass, if necessary, and to acquire the same capability – on the assumption that eventually India would make the Bomb. Would not the Indian policy-makers make the assumption and proceed accordingly to the next phase – of being ready to fit the fuse and connect the wires on their nuclear bombs, if they remain prudent? And, of course, Pakistan would have to do the same.

What would that mean is not difficult to see. Despite protocol utterances and free association of ideas from the use of words like deterrence, tension would continue mounting – until one of two things happen. What are they? It can only be either war or, if there is sufficient popular pressure for a peace settlement born out of a realistic fear of war, an agreement to forego the war option and open a new chapter of friendship. Which of the two is more likely is obvious: The large fund of ill-will between the two countries is still growing and the number of



research purposes. And so forth. The idea appears to be to convince others that we are actually not making any weapons, while our technological capabilities would go on growing. It is doubtful if this rather clever scheme would actually achieve its aim. There is a risk of its proving to be an idea that is clever by half.

The second option — and it is entirely theoretical — is actually to abjure making weapons as a part of larger peace and friendship package with all our neighbours, mainly India. The proof of the pudding has to be in its eating. All our nuclear establishments will have to be thrown open to any neighbour whom we want to convince. This can only be a part of a larger scheme of de-escalating the armament race by our own action, whether or not the others reciprocate in like manner.

These are the only options. The second option one has mentioned (a) is a very real one provided one has the courage of one's conviction; (b) we are self-confident enough as a nation to be able to stand on our own legs and defend our freedom by the sheer will to stay free.

The question is what model can be

followed for Indo-Pakistan relations; once the peace option is adopted by Pakistan. Although there are certain dissimilarities, the Franco-German treaty of January 1963 is still a fine model to be followed by India and Pakistan. That is the way two nations bury the hatchet. It is true the 1963 treaty was based ultimately on two basic facts: the Germans had accepted 1945 defeat to be total and were prepared to forego militarism entirely. Secondly, they were prepared to forego the nuclear option, knowing that France would not. That was not the function of their trust or love for France; their decision to give up militarism as futile was more profound. While Pakistan's 1971 experience cannot be equated with the post-1945 German predicament, it is possible to argue that militaristic options always lead to disaster. Anyhow, for Pakistan to continue to insist on a given balance of power with India is a recipe for an unaffordable arms race, cold war and eventual hot war; this in no way serves any worthwhile interest except that of the military establishment. Thus, despite not seeing a German-like disability, a decision to abjure militarism — arms races of all kinds — would be more rewarding for Pakistan.

CSC: 5100/4729

SYRIA

BRIEFS

NUCLEAR REACTOR REPORTEDLY BUILT--Foreign diplomatic sources have told the Voice of Lebanon that Syria has over the past 3 years built a nuclear reactor in a Syrian mountainous area. Experts from the Eastern Bloc are supervising the reactor which is being protected by a missile defense system. The sources added that the reactor has been built for peaceful purposes. [Text] [NC260631 Beirut Voice of Lebanon in Arabic 0615 GMT 26 May 84]

CSO: 5100/4505

SWAPO THREATENS TO SUE UK OVER URANIUM SUPPLIES

MB120730 Johannesburg SAPA in English 1646 GMT 11 Jun 84

[Text] London, June 11, SAPA — SWAPO is threatening Britain with an international law suit claiming more than rand 1 billion for the uranium Britain has bought from the Rossing mine in SWA/Namibia. It said in a statement issued in London that a SWAPO government would hold Britain's Central Electricity Generating Board — which buys uranium from Rossing for its nuclear power stations — liable for compensation claims under a United Nations decree covering the protection of the territory's natural resources.

"The true costs of uranium from Namibia should, therefore, have reflected a provision for compensation, a demand which will be made with the full authority of international law," it said.

The Campaign Against the Namibian Uranium Contract (CANUC), which supports SWAPO, said the claim could amount to more than 700 million pounds (rand 1,260 million). Britain's uranium supply contract with Rossing will not be renewed when it expires at the end of this year. The country has decided to cut its stockpile by 50 percent and diversify its supply sources. SWAPO and CANUC maintain, however, that at present half of the country's supply comes from SWA/Namibia, and compensation could be claimed on the basis of uranium already purchased.

CANUC said it was seeking from British authorities an undertaking that no new contracts would be sought with Rossing until the territory was independent in terms acceptable to the United Nations, and it maintained that so far the British had been "strangely silent" about future intentions. It is also demanding that the current contract be terminated before the end of the year. Britain does not disclose details of its uranium supplies, or the size of its stockpile.

CSO: 5100/41

## MINISTER ON URANIUM PRODUCTION, TIN RATIONALIZATION

AB070925 Lagos NAN in English 0903 GMT 7 Jun 84

[Text] Lagos, Jun 6 (NAN) — Preliminary reports on the exploration of uranium in Gombe, Bauchi State, are favorable the minister of mines, power and steel, Alhaji Rilwanu Lukman, said in Lagos yesterday. Speaking in an interview with the NEWS AGENCY OF NIGERIA (NAN), Alhaji Rilwanu said that the exploration was to determine the extent and nature of the uranium deposits in the area. He said that the Nigerian Uranium Mining Company (NUMC) was executing the exploratory work and that the search for the metal covered parts of Gongola, Borno and Bauchi. The Nigerian Mining Corporation holds 60 percent of the equity in NUMC and the French firm, Minatom, 40 percent.

Uranium is a dense, hard, radioactive nickel-white metal which can be used as fuel by nuclear reactors principally for the generation [words indistinct]. It is believed that by the end of this century demand for the basic raw material uranium oxide would have reached 165,000 tonnes, up from the 23,707 tonnes used in 1970.

On the tin rationalization policy of the government, the minister said that the Federal Government had approved the scheme and that the Nigerian Mining Corporation in collaboration with the five major tin-mining firms had worked out a time-table for the implementation. Tin rationalization is a scheme which is expected to enhance the productivity better use of equipment. Under the scheme the five major firms will pool their resources and harmonize their processes for the improvement of the tin industry. The firms are amalgamated Tin Mines of Nigeria, Gold and Base Metals (Nig) Ltd, Ex-Lands Nigeria Ltd, Kaduna Prospectors, and Bisichi Jantar.

On Nigeria's membership in the Association of Tin Producing Countries (ATPC) whose headquarters is in Bangkok, Thailand, Alhaji Rilwanu said, "It will not help us to isolate ourselves from the International Tin Council or the ATPC."

"If the tin industry prospers as a result of these two bodies, Nigeria will benefit and, being members, we can influence the two organizations," he said.

The International Tin Council is a body consisting of producers and consumers. It regulates the world tin market, while the ATPC is made up of only producers, and includes Thailand, Malaysia, Nigeria, Zaire and Indonesia.

# U.S. ANTI-NUCLEAR CAMPAIGN CRIPPLES BEISA

Johannesburg SUNDAY TIMES-BUSINESS TIMES in English 6 May 84 p 3

[Article by Don Robertson]

[Text] HIT by fall-out from the anti-nuclear campaign in America and Europe, Gencor's Beisa uranium mine is to close after R225-million and at least 19 lives have been spent in its two-year life.

The mine never made a profit.

Management at Gencor decided to close the mine instead of spending another R100-million on gaining access to additional reefs.

A 50% rise in production costs since the mine was opened, coupled with declining uranium prices in the wake of Three Mile Island and all that, made the operation unprofitable.

## Hysterical

Beisa supplied mainly Japanese buyers, who were little affected by an anti-nuclear campaign that reached hysterical proportions in America and Europe after the Three Mile Island accident. This campaign led to a freeze on nuclear power and the cancellation of several multi-billion dollar nuclear power stations in the US. As a result the international price of uranium was almost halved.

Beisa's supply contracts will be taken over by the Nuclear Fuels Corporation (Nufcor).

Gencor reckons all of the 5 000 workers on the mine will be absorbed elsewhere in the group. The equipment will be sold.

The only cheerful note in the unhappy saga comes from Johan Fritz, executive director of mining at Gencor, who says: "The chances are good that the mine could be reopened later.

"A recovery in the gold price (which is produced at Beisa as a by-product) could have pulled us straight quicker than the uranium price."

St Helena acquired the rights to the mine in June 1981 and a large part of the financing of the project, estimated at R120-million, came from assessed tax losses associated with the deal.

Shareholders' investment in the hands of Gencor, Gencor Investments and Anglo amounts to R12-million. A total of R6-million was spent on hostel facilities, with the balance of about R70-million provided as consumer finance by customers.

Mr Fritz says that as Nufcor has taken over the supply contract, the consumer loan will be reduced by the sale of uranium to the customer at reduced prices as previously agreed. The sale of equipment could raise about R50-million, depending on the state of the second-hand market.

The decision to halt operations comes when the mine, officially opened in March 1982, was reaching peak production. Mill throughput was up to capacity of 100 000 tons a month and gold and uranium recovery had reached the expected 1,86g/t and 0,55kg/t respectively.

The end to operations at Beisa will have little effect on St Helena.

CSO: 5100/39



## CONTROVERSY OVER KOBBER

by J. L. L. L. L.

Johannesburg: 1984

[S. Afr. J. Sci. 84 pp 10-13]

[Article 10-13]

[Article 10-13]

[Text]

**I**T should have been an occasion of collective national pride. After six years of feasibility studies followed by eight years of building, Koeberg, South Africa's first nuclear-fuelled power station began, in the first week in April, to feed electricity into Eskom's national grid.

But the massive structure that dominates the bare, bleak west coastline of the Cape, just 30km north of the city, remains the subject of a controversy without the satisfaction of convincing or conclusive arguments on either side.

Eskom are filled with pride and enthusiasm about their new technological marvel. And justly so, because, whatever else, Koeberg is unanimously acclaimed as one of South Africa's most outstanding civil engineering achievements of the decade. But it is going to be a hard sell to convince their consumers, particularly in the Cape, that nuclear power need not mean imminent disaster, an early demise under an atomic cloud.

Uninformed opinions on Koeberg tend to be geographically biased. Capetonians are anti, because they suspect they will have to pay more for their electricity in spite of assurances from Eskom that they won't. And on principle they dislike massive industrial developments that mar the beautiful Cape.

The fact that the most viable alternative, generating power in coal-fuelled power stations in the Transvaal and transmitting it down via the national grid, would mean more pollution in the north, as well as making the Cape's link with power rather too vulnerable for comfort, is, as an argument, a non-starter. The Transvaal is so rich in energy that

a little more pollution wouldn't matter to those far away in the Cape. Come to think of it, why not a nuclear power station in Johannesburg, because if that had to blow up, so what?

Transvaalians tend to think Cape people, typically feckless in not having their own coal reserves, deserve Koeberg.

**'W**hat do they need power for anyway?' joked an Eskom official. 'They all live in the dark.'

The case for Koeberg is that more energy was needed to cope with the industrial development in the Western Cape and a nuclear-fuelled power station seemed the most feasible way of providing it. For, while South Africa has the fourth largest reserves of coal in the world, these are confined to the Transvaal and Natal.

**T**he logistics of raiiling the coal needed to fuel a station of the size required work out something like 15 trains of 30 coaches each per day. Then there would be the problem of waste disposal — in the north, slag is returned underground for use as "fill" in mined out areas, a solution of satisfying neatness, with no counterpart in the Cape. Generating the power at the source of the coal and transmitting it by power line was another option, but one so fraught with sabotage potential as to make it inadvisable.

As South Africa has plentiful supplies of uranium, it seemed wise to introduce an alternative fuel to coal, for although South Africa has coal resources that should last well into next century, coal has other equally vital roles in the economy — as a source of oil, for the manufacture of plastics and as an export.

"Always remember that setting up a new power plant is not a short term project," says Etienne du Plessis, PRO for Eskom in Johannesburg, who has been closely involved with the Koeberg project since its inception. "It takes eight years to complete just the first generating set of a new power station, so decisions are made a decade or so before a new station actually comes on stream. Eskom has to have a continuous and flexible programme."

"Usually we have four or five power stations simultaneously under construction, so one generator at each can be put into service in the same year. This means projecting electricity needs years ahead. The research that preceded the decision to build Koeberg proved that, at the time, it was an economic as well as a practical proposition."

**T**hen costs rose dramatically when purchases for Koeberg were at a peak, and there have been a lot of extra expenses, with the result that the price of nuclear power, 5.6 cents per kilowatt, now compares unfavourably with 4.7 cents from an equivalent Cape-sited coal-fuelled plant, or 4.3 cents for transmitted power. But these figures are sensitive to increases in the coal price or rail tariffs, for example. So these differences could even out in a few years' time."

**N**evertheless, at Koeberg on March 14, 1984, reaction began in the Unit One reactor core, the heart of the nuclear power production process. It took 24 hours to "go critical", the industry's term for self-maintaining reaction. This was followed by a long testing period at 10 percent of power potential to ensure all systems were performing according to the safety levels set.

Output was then increased to 30 percent of capacity, but the exact level to which the reactor will be allowed to go will depend on the outcome of the stringent tests, mandatory in the granting of a licence to operate, which is granted by the Atomic Energy Corporation. Tests will continue till July, by which time Unit One will be feeding its total output into the national grid. Unit Two, now in the final stages of construction, is expected to enter its power production licensing phase towards the end of the year.

• Like it or not, South Africa has now become one of the 35 countries in the world who have made their commitment to nuclear power.

Koeberg Alert, a Cape Town-based or-

ganisation with the objective of making the public aware of the implications of nuclear power and nuclear technology in society, doesn't like it. On "reaction day", while all those connected with the Koeberg project were celebrating their triumph, 300 people crammed into the Rondebosch Town Hall in Cape Town in response to a call from Koeberg Alert. In a meeting spiked with drama and emotion, a resolution was passed to call on the Atomic Energy Commission to withdraw operating licences until emergency procedures had been tested in an operation involving all people likely to be involved in the event of a nuclear accident.

Other conditions were that Eskom should not control the Emergency Plan; that the public must know of the plan and the wind pattern on which it was based; that a permanent solution for nuclear waste be made public; that assurances be given that full environmental studies would be made before any further nuclear plants be considered. "The siting of Koeberg can never be justified," said Mike Kantey, former secretary of Koeberg Alert and one of the main speakers.

"In the United States, control of the Emergency Plan is in the hands of the local health authorities," says Koeberg Alert's PRO, John Venn. "We would like the same situation here. Dealing with an emergency would involve a conflict of interests for Eskom. They have a vested interest in the continued use of nuclear power, and if there were a choice of two paths of action they would obviously choose the one more convenient to themselves and the one that would cost less, because they would have to foot the bill."

**T**his brings home to us very strongly that our number one priority is to feed the public as much information as we can," says Donne Murray, Information Officer at Koeberg. With a Bachelor of Science degree in physics and geology and an Honours degree in geophysics, he is more than qualified to do this and brings a commitment as well as specialist knowledge to his job — which he describes as "nuclear public relations".

Donne has been at Koeberg for a year. He heads an information centre which is open to the public and is actively canvassing for group tours by schools and interested parties. Visitors are given a slide presentation in addition to a guided tour of a splendidly mounted and easily comprehensible exhibition.

"I think we scientists are perhaps

guilty of not explaining fully what nuclear power is all about. The anti-nuclear lobbyists, on the other hand, are guilty of sowing the seeds of suspicion, distrust and fear, though the positive outcome of the critical spotlight being permanently focussed on the nuclear industry is that systems are constantly being improved to foolproof level. What we need to do is state the facts accurately. It is impossible for a thermal reactor to explode like a nuclear warhead for example.

"But it would be foolish to ignore the fears and concern of groups like Koeberg Alert, because these are likely to be common to many people.

"Take three points made at the meeting. First that Escorn should not control the Emergency Plan, presumably in case we wanted to conceal, or at least make light of, a potential or real disaster, which, simply, we could not do. Well, I think it makes sense for the people who know what is happening, and why, and who are thoroughly drilled in the correct procedures in case of accident, to mastermind the Emergency Plan.

"The plan, incidentally, was successfully demonstrated to members of the Council for Nuclear Safety and the Licensing Branch of the Atomic Energy Corporation in September last year as a prerequisite for the start up of the station. It has now moved into a maintenance phase in which it will be steadily refined and demonstrated annually in increasingly searching exercises.

"A pamphlet on emergency procedures is being sent to every householder in the area within a 60km radius of Koeberg and an advertising campaign has been run in local newspapers. Potassium iodate tablets are being issued free at municipal health clinics.

"As for the second point made at the meeting, mobilising the whole of the Cape in a mock emergency exercise, just imagine the disruption and chaos. Would you be prepared to seal up your windows and doors just for the satisfaction of knowing that in case of accident this is what you would have to do? Or evacuate your home, along with several thousand others, just for the exercise? The idea is not practical.

"We can also justify the siting of Koeberg. The site is geologically stable, we can use the cold Atlantic seawater to cool the condensers, a big plus in a drought-wracked country, and there is convenient access to the national grid. As for its proximity to Greater Cape Town, this is not a consideration. If you

look at the siting of nuclear power stations worldwide, some, particularly in France, are within 2km of populated zones."

Nevertheless there was the Three Mile Island disaster, which brought the potential dangers of a nuclear plant situated in a built-up area into sharp focus. Words like "meltdown" and "radioactive fallout" suddenly became part of everyday language and, with Koeberg nearing completion, the drama assumed a frightening reality. Then, in December 1982, four explosions rocked the plant, with the ANC claiming responsibility. All this has culminated in a public unease, often not formulated, which caused an escalation of opposition to the scheme.

**P**eople fear nuclear power. Is it a precursor of disaster, or a peaceful and inevitable development of the most benign energy source known?

Much was made of the decision of Cape Town's Medical Officer of Health, Dr R Coogan, to sell his house at Melkbosstrand and move to Gordon's Bay. He said: "I do not want my children growing up in the shadow of Koeberg." On the other hand, plots at Melkbosstrand, when available, have trebled in value in the past year.

"If you sat next to a nuclear plant for a whole year you would be exposed to less radiation than on a flight to London. I would rather live at Koeberg than with a wife who smokes," says Dr Denis Toens, forthright manager of the Geology Department of the Nuclear Development Corporation, and determined pro-nuclearist.

He has assembled a barrage of facts and figures which he dispenses in quotable quotes to any gathering from women's club lunches to august scientific seminars. As a scientist, he is convinced that anxieties about nuclear installations are without serious foundation, propounded by a sensation-seeking Press, whom he castigates at every opportunity.

"Journalists like to use inflammatory language, like 'deadly radiation'," he says accusingly. "But what about 'lethal water' when referring to the 1 300 annual drownings in South Africa, or 'deadly automobiles' which kill more than 9 000 people a year?"

"In fact, every informed scientist will agree that radiation is far better understood than air pollution, food additives, chemicals and almost any other environmental agent introduced by technology."

Dr Toens was closely involved in the selection of a suitable site for the Atomic Energy Corporation to purchase for the storage of low-level radioactive waste. He pronounces himself well satisfied that the 10 000ha of barren, arid land in Namaqualand — with a population density of less than one person per square kilometre and where it hasn't rained for eight years — is ideal.

"We must accept that we live in a changing world. People demand improved living standards and this requires cheap, efficiently generated, pollution-free electrical power, using all options, without which progress just cannot take place," says Dr Toens.

According to Professor Robert du Pont, Professor of Psychiatry at Georgetown University in the US, fear of nuclear power has its roots in the psychology of fear. People have an excessive fear of single big risks (plane crashes) compared to risks spread over time and space (car accidents). There are also the factors of who controls the risk (yourself or others), whether it is a familiar risk (like cigarette smoking), or whether the risk is associated with something needed or wanted, in which case fears can be overcome.

Taken in this context, the acceptance of nuclear power has all the cards stacked against it. Meltdown is a single big risk, the risk is controlled by others, nuclear power is unfamiliar and widely perceived as unnecessary.

Visiting Koeberg is scary all right, but the fears have nothing to do with meltdown. The reactor building which houses Unit Two (Unit One, having started up, is now a totally restricted area) is vast and stark and the approach to it is a seemingly endless progress through stringent security checks and along confined walkways flanked with massive coils of barbed wire, all electrically charged.

There is an eerie lack of people, for though there are still more than 1 000 contract workers on site, the scale is so large they diminish. You are aware only of the ever-present security guards who examine identity documents and permits at every one of the many checkpoints.

Any attempts at sabotaging the reactor from outside would have to contend with the massive strength of the containment building, which could withstand virtually anything short of a nuclear bomb. The building would also retain radioactivity resulting from sabotage from within, which perhaps best gives some idea of the thickness of the walls,

the density of being utterly and completely sealed into this unknown world.

Inside a reactor is no place for claustrophobics, or for those who suffer from vertigo for that matter.

A sense of awe quickly overcomes the mild panic. You are face to face with a nuclear reactor, a place where few others have been, that will soon be sealed off for ever, from everyone but the few operators directly involved in occasional maintenance and refuelling (one third of the fuel is replaced annually once nuclear reaction starts).

Those anticipating the inevitable questions on safe levels of radiation, is careful to point out a radiation monitoring device. Alarms go off if a certain dose level is exceeded and staff must evacuate immediately.

"Workers on a nuclear plant may not exceed a radiation dose of 5 rems in a year," he explains. "And this has to be spread out over the 12 months. The maximum total dose for a worker is 50 rems spread over a working lifetime. But that would be most unlikely."

Down, down and even further down a vertical iron ladder, you find yourself underneath the reactor building, below sea level on the lower raft. It is built of steel-reinforced concrete, 2m thick on a 6m thick foundation of soil and cement that covers the surface bedrock.

Five hundred concrete pedestals support the upper raft which "floats" on seismic bearings, of which there are up to four on each pedestal. On the top of each pillar and under the platform is a narrow band of flexible, rubbery material to absorb movement in case of seismic tremors.

It is a three-hour exercise viewing the entire Koeberg power station, for although the turbines, generators and condensers are the same as found in a coal-fired plant, there is the excitement of seeing these sparkling new installations in action.

Perhaps that is why Eskom organise afternoon visits, because by the time you drive back to Cape Town, Koeberg Power Station is a dramatic silhouette against the late afternoon sun on Table Mountain, a juxtaposition of space age technology and a millennium of existence, each in its ultimately different way, a spectacular creation.

Lights begin to prick the darkening mass, lights now generated by nuclear power. The usual belch of coal fumes, trapped in the layer of smog that is

associated with a power station, is absent. You can't help but be pleased that a 3-million-tons-of-coal-a-year plant on the scale of Koeberg isn't ever going to mar this scene. But this is a purely aesthetic viewpoint, inspired by the beauty of the picture, dismissable on every other level.

**F**or the big question remains. Is the clean, contained, but sinister, waste of Koeberg the better alternative? Koeberg Alert say not, quoting facts and figures that quite correctly prove a swing away from nuclear power in the US.

John Venn feels that the money spent on Koeberg could have been better used on research into solar power development and on improving methods of pollution control.

But that wouldn't have given the Western Cape the power it needs now. And the suggestion that tax incentives be introduced for electricity conservation is not a long-term solution in an industrially developing country.

Only in time, certainly not before the end of the century, will it be valid to assess nuclear power and, even then, it would have to be in the context of the power sources that exist now and will have developed since. And by then the Koeberg plant will be nearing the end of its useful life and plans for decommissioning it will be well under way.

So perhaps there never will be an answer to the current controversy — not one which satisfies all sectors, anyway. ●

OFFICIAL SEES NO NEW NUCLEAR POWER STATIONS SOON

MB241100 Johannesburg RAND DAILY MAIL Business Day Supplement in English  
24 May 84 p 5

[By Priscilla White]

[Text] Nuclear power generation by ESCOM [Electricity Supply Commission] is viable only at the coast, says Mr Jan Smith, its chairman.

He recently told the nuclear physics research unit of the University of the Witwatersrand: "Based on present projections of growth in these areas, I do not foresee the need for any further nuclear power stations before the end of the century."

He added that a number of economic and environmental considerations might change the situation.

If the cost of coal rose to such an extent that nuclear power became competitive, ESCOM would have to reconsider more nuclear power stations.

The environmental impact of coal-fired power stations was beginning to make itself felt and Mr Smith acknowledged that the advent of acid rain was--right or wrongly--causing widespread concern.

"In future coal-fired plans may be exposed to the same type of public concern and scrutiny to which the nuclear plant has been subjected."

Because of the possibility of droughts he doubted whether it would ever be advisable to build nuclear power stations in the interior.

ESCOM used only a small amount of water resources, but in a major drought such as the present one, even its relatively modest requirements became difficult to meet.

The problem did not arise at the coast where seawater was used for cooling.

When ESCOM revealed the cost of a kw/hour of electricity from a coal-fired plant. [sentence as received]

Mr Smith said Koeberg was not an economic failure and that it was extremely difficult, if not impossible, to quantify the true cost of nuclear power at the moment.

"Koeberg as South Africa's first nuclear power station has been burdened with many costs which will make better sense only in the longer term when more nuclear power stations are built.

He said Koeberg was the forerunner of ESCOM's entire nuclear programme which would begin to mature in the next century.

Although South Africa was rich in natural resources, its energy options were limited to coal and uranium.

ESCOM's programme was dominated by coal-burning power stations and seemed likely to remain so until well into the next century.

CSO: 5100/40



EFFECTS OF NUCLEAR ATTACK ON JOHANNESBURG PROJECTED

Johannesburg RAND DAILY MAIL in English 12 May 84 p 8

[Article by Michael Stent: "No Place To Hide on Nuclear D-Day"]

[Text] IMAGING a pile of TNT stretching from Johannesburg to Durban, 200m wide and about 100m high. Then consider that one cubic metre of that pile would ruin a building the size of the Carlton Centre.

That gives some idea of the destructive potential of the world's arsenal of nuclear weapons.

Or, if that is too difficult, consider that one modern nuclear weapon can have an explosive power greater than that of all explosives used in all wars since the invention of gunpowder.

The mere numbers involved in considering thermonuclear weapons are virtually beyond conception. What would happen to people in the event of even the most limited form of nuclear warfare is equally difficult to imagine.

The extent of death, injury and destruction in nuclear warfare, and the ability of medical services to cope with them, are the subjects of a recently released report of a committee established by the World Health Organisation.

It makes chilling reading. Compiled by a committee of scientists and doctors from Sweden, Britain, Russia, Austria, the Netherlands, the United States, Nigeria, Japan, France and Venezuela, the report focuses on three possible types of nuclear warfare:

--The explosion of a one megaton bomb (the equivalent of one million tons of TNT) over a large city--they use London as an example. More than 1,5-million people would die and as many would be injured;

--"Limited" nuclear warfare with smaller tactical nuclear weapons totalling 20Mt, aimed at military targets in a relatively densely populated area. About nine million people would be killed or seriously injured, of whom more than eight million would be civilians;



--An all-out nuclear war using at least half the estimated stockpile of 20 000Mt (the equivalent of 20 000-million tons, or about 14 000-million cubic metres of TNT). More than 1 000-million people would be killed and another 1 000-million injured.

The committee concedes much of its work is guesswork. The primitive atomic bombs exploded by the United States over Hiroshima and Nagasaki were tiny in comparison to modern nuclear weapons--only 12,5 kilotons, the equivalent of 12,500 tons of TNT.

There has been no natural disaster in which anywhere near a million people have died and as many have been injured -- and all that in the space of minutes.

But then who would quibble if the report is a couple of hundred thousand people out either way.

The basic problem in making predictions about nuclear warfare is that it would not simply be something like the Second World War but on a larger scale.

In sheer quantity of explosive power there has, of course, been a huge increase. The nuclear arsenal has about 5 000 times the power of all the explosives used in the Second World War.

And while the huge "blockbuster" bombs of the Second World War contained 10 tons of TNT, a modern nuclear weapon of the same weight could have an explosive power equivalent to 20-million tons of TNT. With modern rocketry, this could be delivered anywhere in the world.

Wars would take days and not years. The measure of victory or defeat would be a contorted exercise in logic.

But the major difference between nuclear and conventional weapons is that the former adds another killer -- radiation.

Conventional and nuclear weapons both kill and maim by blast and heat -- and again there is a vast difference in the scale of destruction.

Almost half the total energy released by a nuclear explosion is in the form of a massive blast wave, at its most intense at the centre of the explosion and gradually diminishing until it is

dissipated perhaps tens of kilometres from the blast.

With a 1Mt bomb exploded at a height of 2 400m, the wind speed 1,3km from the centre of explosion at ground level would be 750km/h, levelling reinforced concrete structures.

At 9,5km from the blast centre the wind speed would be 150km/h -- a wind of 120km/h is classified as a hurricane -- strong enough to kill people in the open and severely damaging houses.

Even 18km away, the wind speed would be 60km/h, causing damage to structures. People could be killed or seriously injured by collapsing buildings or flying glass and other debris.

The thermal wave, or heat flash, contains about a third of the energy released by a nuclear bomb. It is a result of the extremely high temperature generated at the moment of the explosion and lasts from between a second and 10 seconds.

It travels at the speed of light and again dissipates as it travels away from the centre of the blast. The effect of the immense heat is to vaporise everything within a certain distance (in Hiroshima nothing remained of some people but their outlines on stone benches) melt solids at greater distances, and start fires still further away.

These fires would start a fire storm, similar to those of Dresden and Hiroshima during the Second World War. Within the area of the fire storm temperatures would reach such heights that even people in secure shelters could be cremated

or die from lack of oxygen.

To these "traditional" methods of warfare is added radiation, both an initial burst of neutrons and gamma-rays in the first minute, and local and global radioactive fallout over a longer period.

With the exception of neutron bombs, initial radiation would not contribute much to casualties. Radioactive fallout, however, continues killing after the actual detonation, can affect people far from the explosion, is a major obstacle to effective rescue operations and medical care, and can harm future generations long after a war ended.

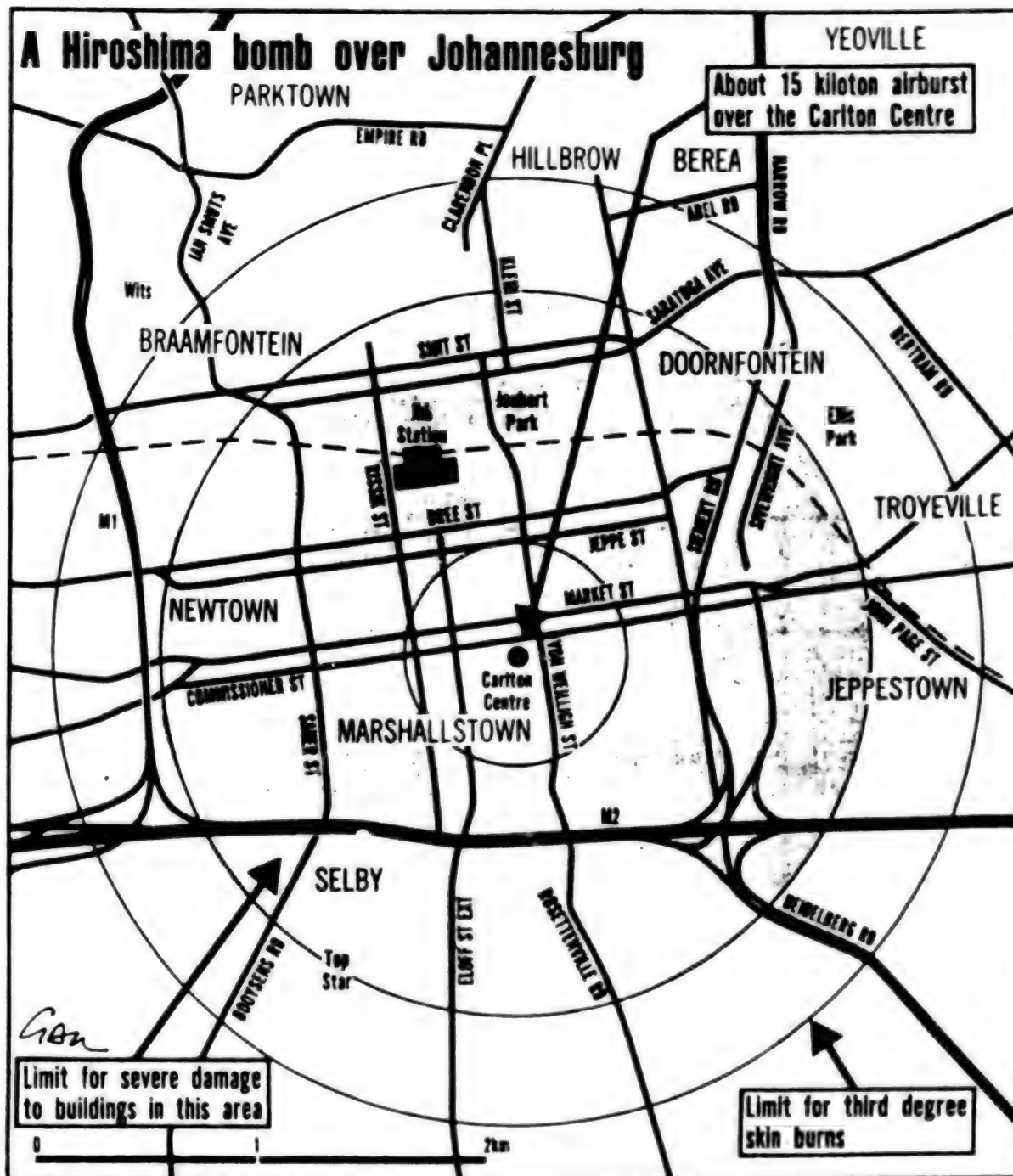
Fallout is caused by radioactive particles falling back to earth after the explosion. Locally this consists of irradiated dust and debris, globally of radioactive particles injected into the upper atmosphere which fall over great areas weeks or months after the blast.

The proportion of people killed or injured by each of blast, heat and radiation depends on factors such as the height of the explosion and atmospheric conditions.

But the result, whatever the permutations, is much the same. A 1Mt bomb detonated over London at low altitude would kill 1 800 000 and injure 1 700 000; at high altitude would kill 1 600 000 and injure 1 600 000.

The management of casualties on this scale could only be haphazard. Switzerland boasts that most of its population would be housed in effective shelters in the event of nuclear war. It is the exception.

At best most countries



have provided only for the government, military, and civil service elite. At worst, like Johannesburg, no provision for nuclear warfare has been made.

Cynically, Johannesburg might have made the correct decision. A study of a 1Mt blast over Boston, which has a similar population to the Johannesburg metropolitan area, shows half the people would be killed or injured initially.

If half of Boston's 5200 doctors survived the blast, they would have to treat 700 000 injured in the 2 000 remaining beds. They would have no infrastructure to support them — blood supplies, water, electricity, communications, sanitation, transport, drug manufacture all would be more or less seriously disrupted or destroyed.

What medical care could be given would be ad hoc; thousands with injuries that could be treated, even relatively minor injuries in different circumstances, would die.

The report says that even if the rest of the United States was intact, its medical resources would be unable to deal adequately with disaster on this scale.

Perhaps the WHO spent a good deal of money answering a rather stupid question — like asking a doctor how to treat a person who has been decapitated in a car crash.

But it does reach a predictable conclusion:

"Therefore the only approach to the treatment of the health effects of nuclear explosions is primary prevention of such explosions, that is, the prevention of atomic war."

In other words, it's another way of paraphrasing the song that started back in the sixties about banning the bomb.

## COMMENTARY ON 6-NATION PLEA TO HALT NUCLEAR TESTS, DEPLOYMENT

Dar es Salaam DAILY NEWS in English 24 May 84 p 1

[Editorial]

[Text] **WHILE** the United States and the Soviet Union blame each other for lack of progress on arms control, the inexorable spiral of the arms race is far from abated.

At the same time, the indifference that people have towards the terrifying prospect for nuclear war only serves to encourage nuclear arms escalation.

Pressure groups ranged against the arms race have been gaining momentum, but their noble work is hindered by the remaining pockets of ignorance of the effects of confrontation between the super powers.

However, it is a fact that ever increasing expenditure on armaments brings no greater security to the spending countries, and can obliterate the very economies they are claiming to be safeguarding.

The six-nation (Tanzania, India, Sweden, Mexico, Greece and Argentina) appeal for a halt to testing, production and deployment of nuclear weapons ought to be taken very seriously.

The bragging reaction of

any one of the nuclear weapon states to the four-continent leaders' appeal, we hope does not represent the thinking of their nationals who are as threatened by the prospects of a nuclear war as any elsewhere in the world.

All the six leaders have been saying is that the nuclear arms race is militarily misguided and dangerously out of control. They reflect the global desire to make disarmament the best course of action for both the super powers.

We know for a fact that the nuclear arms race is fueled not so much by military needs, but the mutual suspicion of the US and Soviet Union as to who is capable of destroying who, at what speed and accuracy.

It also confounds reason that some of the world's most respected scientists, both in the West and East, take pride in the terrible armament careers.

Equally frightening is that the effects of nuclear war are far-reaching. Sensible scientists have cautioned that the tropical

Third World will not escape devastation, even if war is fought only in the North.

That is why it is important that the Third World public is sensitised not only to the dangers of the nuclear arms-race, but also to the need to reverse the growing rate at which military expenditure keeps increasing in the Third World.

Attention must at the same time be directed to the spread of the so-called peaceful nuclear technology, and of the technical knowledge and expertise required for nuclear weapon production.

For this is resulting in more and more countries, including some of the signatories to the latest declaration, having all the capability or potential to produce nuclear weapons.

The way forward is a ban on all bomb testing, discontinuing invention of new designs and getting the super powers to resume talks on arms control on the basis that deterrence is best possible where there are no warheads at all.

## BRIEFS

NISA URANIUM INDUSTRIAL COMPLEX--An industrial complex for the exploitation and treatment of uranium in Nisa, which possesses the country's principal resources, is scheduled for completion by the end of this decade. The uranium-exploiting firm now operating in Upper Alentejo foresees the exploitation of eight of the existing deposits and, on this basis, within 5 years the Nisa operation will be in full swing. The Nisa deposit will be able to produce more than 1 million tons annually. The mineral will be extracted from the ore thus mined and will be concentrated about 900 times, thus being converted into a marketable chemical compound known as diuranate of ammonia. Uranium resources in Portugal are estimated at about 8,400 tons, divided into three areas: Urgeirica, with 34.2 percent of the production; Guarda, with 11.2 percent; and Upper Alentejo, with 54.6 percent. According to the exploiting firm, during the first 5 years mining will be confined to the Nisa deposit, which contains 64.8 percent of the area's total reserves. [Text] [Lisbon TEMPO in Portuguese 17 May 84 p 23] 8568

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PROBLEMS WITH DISPOSAL OF RADIOACTIVE WASTE

Zurich NEUE ZUERCHER ZEITUNG in German 2 Jun 84 p 35

[Article by sda: "Deadline Problems with Nuclear Waste Disposal"]

[Text] Bern, 28 May--Despite the fact that the responsible federal agencies are showing some skepticism, the decision stands for the time being: the National Association for Storage of Radioactive Waste (NAGRA) must observe the year-end 1985 deadline for furnishing proof that permanent and secure disposal of nuclear waste is possible in Switzerland. In its sixth activity report, the Federal Working Group for Nuclear Waste Disposal (AGNEB) offers the opinion that a possible extension of the deadline for submitting Project GEWAHR [SECURITY] should not be discussed pending availability of the NAGRA report promised for the end of 1984.

AGNEB, established by the Federal Council in 1978, in which all federal agencies concerned are represented, is responsible for monitoring all activities in the area of nuclear waste disposal and for making appropriate recommendations. Thus, apart from the difficult deadline situation, its 1983 report discusses primarily the problem of burying radioactive wastes in deep lakes. In addition, there are reports about the activities of the individual federal agencies and about the research activities of the Federal Institute for Reactor Research (EIR). Finally, the report contains contribution from the executive agencies, from NAGRA itself and from the energy department.

In August 1983, the Geology Committee of AGNEB had proposed to the Federal Traffic and Energy Management Department (EVED) that NAGRA be granted an extension beyond 1985 of the deadline for submitting Project GEWAHR on the subject of highly radioactive waste. "The reliability of the results is of greater importance than meeting deadlines," says the activity report of the working group itself. It states further that it is indeed uncertain that the GEWAHR report could be properly substantiated with research results in the time available. However, it goes on, at the present time a request for deadline extension would be premature--first one would have to await the NSGRA report promised for the end of 1984, since only the data it will contain will make possible a determination of how much additional time might be necessary.

AGNEB's skepticism toward excessively optimistic deadlines applies equally to the disposal of all types of radioactive waste. The activity report states that a final resting place for low and medium strength radioactive waste could start operating by the deadline only "if no more major delays are encountered in the approval hearings." Also, that the short and all too optimistic time schedule would specifically make it impossible to switch to an alternative project without a major delay. Here, as well as with the highly radioactive wastes, the lack of timely feasible alternatives constitutes a deficiency in the disposal concept.

Apart from the establishment of a final storage site for low- or medium radio radioactive wastes, AGNEB considers the most urgent task for intermediate term planning to be the creation of a central intermediate storage facility for burned out reactor fuel elements as well as for highly, slight and medium radioactive recycling wastes. But here too, the working group believes that the schedule could be adhered to only with great difficulty; it provides for a general proposal at the end of this year, with start of operations in 1992 at the location of the former Lucens test reactor. However, the nuclear power station operators and designers for their part stated that various essential features of the storage project (capacity, proven technology) had been verified.

During the reporting year, efforts toward nuclear waste disposal were marked nationally as well as internationally by severe disagreements concerning the deep-lake disposal of low and medium grade radioactive wastes. The boycott of the proposed measures had an impact in Switzerland also, after some waste materials had already been prepared for disposal. Based on an AGNEB report, the Federal Council decided in mid-February to establish an intermediate storage facility for low and medium grade radioactive wastes from industry, research and medicine on the EIR grounds in Wuereligen, in anticipation of the final disposal site planned for 1995. In accordance with the recommendations of the working group, the Council specifically reserved for itself the option of initiating additional under-water disposal measures.

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## INTERNATIONAL FLURRY OVER AKKUYU NUCLEAR PROJECT

Istanbul CUMHURIYET in Turkish 24 Apr 84 pp 1, 11

[Text] Because of construction of the Akkuyu Nuclear Power Plant, in which heads of state and government got involved, Ankara has become a stage for the colorful lobbying activities of international firms and their meetings with government officials that are being held one after another.

In recent days, the plan for construction of the Akkuyu Nuclear Power Plant on the coast of the Mediterranean near Mersin has become an international problem. According to a report in the most recent issue of the weekly DER SPIEGEL of West Germany, U.S. President Ronald Reagan has written a letter to Helmut Kohl, chancellor of the Federal Republic, in which he criticized "the issuance of a government guarantee to the German firm bidding for the Akkuyu Power Plant" and stated that "such a guarantee disturbs conditions for free competition, and therefore the German Government should abandon its position."

According to the report, the letter written by Reagan in reference to the Akkuyu Power Plant was sent to Bonn 2 to 3 months ago. Since the letter was sent, the three German, Canadian and American firms competing for the Akkuyu Power Plant have made intensive contacts in Ankara. About 2 weeks ago, each of the three firms applied on the one hand to the Ministry of Energy and on the other hand to the State Secretary for the Treasury and Foreign Trade, and notified them that they "guaranteed the entire loan of DM3 billion to be used for construction of the power plant." According to the report, whereas previously only 85 percent of the loan for the power plant had been guaranteed, following Reagan's letter the entire loan has been guaranteed by each of the firms. Two weeks ago the guarantee certificates of the firms were submitted to the Ministry of Energy as well as to the State Secretary for the Treasury and Foreign Trade.

The recent meetings that were held one after another between the German, American and Canadian firms wanting to participate in the construction of the power plant and the Turkish officials were another interesting aspect of these developments. Just before the elections on 6 November, a letter of intent was submitted to each of the three firms, "commencement of negotiations for discussion of the terms for the construction of the power plant" was requested and the conclusion of these negotiations by 30 April 1984 was projected. However, in the meetings held with each one of the foreign firms, it came to light that the Ozal government "extended the time period for the negotiations until June."



The separate submission of a letter of intent to each one of the firms before the November elections was perceived by the firms as an indication that three different nuclear power plants would be built in Turkey. The firms, which got the impression that "construction of the No 1 and No 2 units of the Akkuyu Power Plant had been commissioned to the German and Canadian firms and construction of the power plant at Sinop to the American firm" learned later that "at the moment, Turkey will build only one nuclear power plant."

Therefore, in recent days competition among the international firms has accelerated, and even the U.S. president and the chancellor of the FRG have gotten involved in the matter. Now the decision will be made by the Ozal government, but the anxiety of the firms will continue until the beginning of June.

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